NOAA SCIENTIFIC PUBLICATIONS REPORT
SEPTEMBER 26, 2016

HIGHLIGHTED ARTICLES

Invasive lionfish reduce native fish abundance on a regional scale
Scientific Reports (5.228)

Determining oil and dispersant exposure in Sea Turtles from the northern Gulf of Mexico resulting from the Deepwater Horizon oil spill
Endangered Species Research (2.259)

Effects of biological, economic and management factors on tuna and billfish stock status
Fish and Fisheries (8.258)

Climate science strategy of the US National Marine Fisheries Service
Marine Policy (2.621)

Using present-day observations to detect when anthropogenic change forces surface ocean carbonate chemistry outside preindustrial bounds
Biogeosciences (3.753)

Interhemispheric SST gradient trends in the Indian Ocean prior to and during the recent global warming hiatus
Journal of Climate (4.850)

Ecological and economic consequences of ignoring jellyfish: A plea for increased monitoring of ecosystems
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CROSS LINE OFFICE ARTICLES

No evidence of increased demersal fish abundance 6 years after marine protected area creation along the southeast United States Atlantic coast
Bulletin of Marine Science (1.503)

ADDITIONAL ARTICLES

NMFS Publications

Sea turtle bycatch in the large-mesh gillnet flounder fishery in Carteret County, North Carolina, USA, June-November 2009
Journal of the North Carolina Academy of Science (n/a)

Design and monitoring of woody structures and their benefits to juvenile steelhead trout (*Oncorhynchus mykiss*) using a net rate of energy intake model
Canadian Special Publication of Fisheries and Aquatic Sciences (n/a)

Improving the forecast for biodiversity under climate change
Science (31.48)

Age, growth and natural mortality of schoolmaster *Lutjanus apodus* from the southeastern United States
PeerJ (2.1)

Fine-scale monitoring of routine deep dives by gravid leatherback turtles during the internesting interval indicate a capital breeding strategy
Frontiers in Marine Science – Marine Megafauna Section (n/a)

Locally adaptive nonparametric smoothing with Markov random fields and shrinkage priors
Bayesian Analysis (0.53)

Case diagnosis and characterization of suspected paralytic shellfish poisoning in Alaska
Harmful Algae (3.54)

Joint dynamic species distribution models: a tool for community ordination and spatiotemporal monitoring
Global Ecology and Biogeography (6.76)

parallelnewhybrid: an R package for the parallelization of hybrid detection using NEWHYBRIDS
Molecular Ecology Resources (5.29)

Can autocorrelated recruitment be estimated using integrated assessment models, and how does it affect population forecasts?
Fisheries Research (2.70)

Spatial distribution of reef fish species along the southeast US Atlantic coast inferred from underwater video survey data
Plos One (3.54)

Prioritising research within animal behaviour to increase conservation efficacy
Trends in Ecology and Evolution (TREE) (16.735)

Age, growth and natural mortality of cubera snapper *Lutjanus cyanopterus* from the southeastern United States
PeerJ (2.1)

Hierarchical analysis of taxonomic variation in intraspecific competition across fish species
American Naturalist (4.725)

Saving the Spandrels? Adaptive genomic variation in conservation and fisheries management
Journal of Fish Biology (1.658)

Temporally varying natural mortality: sensitivity of a virtual population analysis and an exploration of alternatives
Fisheries Research (1.903)

Marine shoreline management- a 35 year evaluation of outcomes to San Juan County, Washington, USA
Journal of Coastal Management (1.433)

Reef-scale trends in Florida *Acropora* spp. abundance and the effects of population enhancement
PeerJ (2.183)

A hypothesis of a redistribution of North Atlantic swordfish based on changing ocean conditions
Deep Sea Research II (2.85)

OAR Publications

A complex baleen whale call recorded in the Mariana Trench Marine National Monument
Journal of the Acoustical Society of America (1.503)

Comparing chemistry and census-based estimates of net ecosystem calcification on a rim reef in Bermuda
Frontiers in Marine Science (n/a)

Summertime rainfall events in eastern Washington and Oregon
Weather and Forecasting (1.860)

A multi-decade record of high quality fCO_2 data in version 3 of the Surface Ocean CO_2 Atlas (SOCAT)
Earth System Science Data (8.268)

Evidence for gap flows in the Birch Creek Valley, Idaho
Journal of the Atmospheric Sciences (3.220)

NWS Publications

Skill assessment of techniques for real-time diagnosis and short-term prediction of tornado intensity using the WSR-88D
Journal of Operational Meteorology (n/a)

Comments on "Double impact: When both tornadoes and flash floods threaten the same place at the same time"
Weather and Forecasting (2.35)

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NMFS

The Quantification and Presentation of Risk
Book Chapter

NOS

Mapping ecological priorities and human impacts to support land-sea management of Puerto Rico's Northeast Marine Ecological Corridor
NOAA Technical Memorandum

HIGHLIGHTED ARTICLES

Invasive lionfish reduce native fish abundance on a regional scale
Scientific Reports (5.228)
N. G. Ballew, N. M. Bacheler, G. T. Kellison, A. M. Schueller (NMFS/SEFSC)

- First publication detailing the impact of the lionfish invasion on native fish abundance across a broad regional scale and over the entire duration of the lionfish.
- Lionfish negatively impact native fish abundance in the study area.
- The lionfish abundance, unchecked, will remain at current levels or continue to increase, thereby continuing to impact native fish abundances.

Invasive lionfish pose an unprecedented threat to biodiversity and fisheries throughout Atlantic waters off of the southeastern United States, the Caribbean, and the Gulf of Mexico. Here, we employ a spatially replicated Before-After-Control-Impact analysis with temporal pairing to quantify for the first time the impact of the lionfish invasion on native fish abundance across a broad regional scale and over the entire duration of the lionfish invasion (1990 – 2014). Our results suggest that 1) lionfish-impacted areas off of the southeastern United States are most prevalent off-shore near the continental shelf-break but are also common near-shore and 2) in impacted areas, lionfish have reduced tomtate (a native forage fish) abundance by 45% since the invasion began. Tomtate served as a model native fish species in our analysis, and as such, it is likely that the lionfish invasion has had similar impacts on other species, some of which may be of economic importance. Barring the development of a control strategy that reverses the lionfish

invasion, the abundance of lionfish in the Atlantic, Caribbean, and Gulf of Mexico will likely remain at or above current levels. Consequently, the effect of lionfish on native fish abundance will likely continue for the foreseeable future.
Publication date: August 31, 2016
Available online: http://www.nature.com/articles/srep32169

Determining oil and dispersant exposure in Sea Turtles from the northern Gulf of Mexico resulting from the Deepwater Horizon oil spill
Endangered Species Research (2.259)
G. M. Ylitalo (NMFS/NWFSC), T. K. Collier, **B. F. Anulacion (NMFS/NWFSC**), K. Juaire, **R. H. Boyer (NMFS/NWFSC), D. A. M. da Silva (NMFS/NWFSC**), **J. L. Keene (NMFS/OPR), B. A. Stacy (NMFS/OPR)**

- This manuscript provides information on exposure of threatened and endangered sea turtles to petroleum and dispersant released into the northern Gulf of Mexico (GOM) during the Deepwater Horizon (DWH) oil spill as part of the Natural Resource Damage Assessment process.

Documentation of exposure of threatened and endangered sea turtles to petroleum and dispersant released into the northern Gulf of Mexico (GOM) during the *Deepwater Horizon* (DWH) oil spill was a critical component of the Natural Resource Damage Assessment process. Substances collected from the skin of oiled and suspected oiled turtles were analyzed for petroleum hydrocarbons to determine oiling status and oil sources. Tissue, gastroenteric and bile samples from a subset of visibly oiled and unoiled turtles that died during the spill in 2010 and in 2011 were analyzed for evidence of internal exposure and absorption of polycyclic aromatic hydrocarbons (PAHs) and the dispersant component dioctyl sodium sulfosuccinate (DOSS). The volume of external oil collected from sea turtles was sufficient to confirm the presence of petroleum on 61% (298/492) of turtles and oil from the DWH spill was identified as the source in 97% (221/227) of those turtles in which conclusive comparison was possible. Visibly oiled turtles had higher concentrations of PAHs or fluorescent PAH metabolites compared to those determined in unoiled animals. Findings in most of the unoiled turtles were suggestive of low-level PAH exposure from a combination of petrogenic, pyrogenic and biogenic sources that may represent background values for sea turtles from the northern GOM. Pre-spill samples, however, were not available for comparison. DOSS levels were below the limit of quantitation in all samples analyzed except in an esophagus sample of a single heavily oiled sea turtle. Overall, the results of petroleum chemical analyses for petroleum or

petroleum-derived compounds of both external and internal samples of sea turtles supported the visual oiling observations.
Acceptance date: August 16, 2016
Expected publication date: Fall 2016
Available online: http://www.int-res.com/journals/esr/esr-specials/effects-of-the-deepwater-horizon-oil-spill-on-protected-marine-species/

Effects of biological, economic and management factors on tuna and billfish stock status
Fish and Fisheries (8.258)
M. Pons, T. A. Branch ,M. C. Melnychuk, O. P. Jensen, **J. Brodziak (NMFS/PIFSC)**, J. M. Fromentin, S. J. Harley, A. C. Haynie, L. T. Kell, M. N. Maunder, A. M. Parma, V. R. Restrepo, **R. Sharma (NMFS/SEFSC)**, R. Ahrens, and R. Hilborn

- Globally, for tunas, stocks were more depleted if they had high commercial value, were long-lived species, had small pre-fishing biomass and were subject to intense fishing pressure for a long time
- Implementing and enforcing total allowable catches (TACs) had the strongest positive influence on rebuilding overfished tuna and billfish stocks. Other control rules such as minimum size regulations or seasonal closures were also important in reducing fishing pressure, but stocks under TAC implementations showed the fastest increase of biomass
- Lessons learned from this study can be applied in managing large industrial fisheries around the world. In particular, tuna regional fisheries management organizations should consider the relative effectiveness of management measures observed in this study for rebuilding depleted large pelagic stocks

Commercial tunas and billfishes (swordfish, marlins and sailfish) provide considerable catches and income in both developed and developing countries. These stocks vary in status from lightly exploited to rebuilding to severely depleted. Previous studies suggested that this variability could result from differences in life-history characteristics and economic incentives, but differences in exploitation histories and management measures also have a strong effect on current stock status. Although the status (biomass and fishing mortality rate) of major tuna and billfish stocks is well documented, the effect of these diverse factors on current stock status and the effect of management measures in rebuilding stocks have not been analysed at the global level. Here, we show that, particularly for tunas, stocks were more depleted if they had high commercial

value, were long-lived species, had small pre-fishing biomass and were subject to intense fishing pressure for a long time. In addition, implementing and enforcing total allowable catches (TACs) had the strongest positive influence on rebuilding overfished tuna and billfish stocks. Other control rules such as minimum size regulations or seasonal closures were also important in reducing fishing pressure, but stocks under TAC implementations showed the fastest increase of biomass. Lessons learned from this study can be applied in managing large industrial fisheries around the world. In particular, tuna regional fisheries management organizations should consider the relative effectiveness of management measures observed in this study for rebuilding depleted large pelagic stocks.
Expected publication date: online version available May 2, 2016
Available online: http://onlinelibrary.wiley.com/wol1/doi/10.1111/faf.12163/full

Climate science strategy of the US National Marine Fisheries Service
Marine Policy (2.621)
D. S. Busch (OAR/OA), R. Griffis (NMFS/OST), J. Link (NMFS/NEFSC), K. Abrams (NMFS/OSF/), J. Baker (NMFS/PIFSC), R. E. Brainard (NMFS/PIFSC), M. Ford (NMFS/OST), J. Hare (NMFS/NEFSC), A. Himes-Cornell (NMFS/AFSC), A. Hollowed (NMFS/AFSC), N. J. Mantua (NMFS/SWFSC), S. McClatchie (NMFS/SWFSC), M. McClure (NMFS/NWFSC), M. Nelson (NMFS/OSF), K. Osgood (NMFS/OST), J. O. Peterson (NMFS/OST), M. Rust (NMFS/OA), V. Saba (NMFS/NEFSC), M. Sigler (NMFS/AFSC), S. Sykora-Bodie (NMFS/OPR), C. Toole (NMFS/WRO), E. Thunberg (NMFS/NEFSC), R. Waples (NMFS/NWFSC), R. Merrick (NMFS/OAA)

- Predict future states of ecosystems, living marine resources (LMRs), and LMR-dependent human communities
- Build and maintain the science infrastructure required to fulfill NMFS mandates under changing climate conditions.

Changes to our climate and oceans are already affecting living marine resources (LMRs) and the people, businesses, and economies that depend on them. As a result, the U.S. National Marine Fisheries Service (NMFS) has developed a Climate Science Strategy (CSS) to increase the production and use of the climate-related information necessary to fulfill its LMR stewardship mission for fisheries management and protected species conservation. The CSS establishes seven objectives: (1) determine appropriate, climate-informed reference points; (2) identify robust strategies for managing LMRs under changing climate conditions;

(3) design decision processes that are robust to climate-change scenarios; (4) predict future states of ecosystems, LMRs, and LMR-dependent human communities; (5) determine the mechanisms of climate-change related effects on ecosystems, LMRs, and LMR-dependent human communities; (6) track trends in ecosystems, LMRs, and LMR-dependent human communities and provide early warning of change; and (7) build and maintain the science infrastructure required to fulfill NMFS mandates under changing climate conditions. These objectives provide a nationally consistent approach to addressing climate-LMR science needs that supports informed decision-making and effective implementation of the NMFS legislative mandates in each region. Near term actions that will address all objectives include: (1) conducting climate vulnerability analyses in each region for all LMRs; (2) establishing and strengthening ecosystem indicators and status reports in all regions; and (3) developing a capacity to conduct management strategy evaluations of climate-related impacts on management targets, priorities, and goals. Implementation of the Strategy over the next few years and beyond is critical for effective fulfillment of the NMFS mission and mandates in a changing climate.
Expected publication date: December 2016
Available online: September 12, 2016
http://www.sciencedirect.com/science/article/pii/S0308597X16305723

Using present-day observations to detect when anthropogenic change forces surface ocean carbonate chemistry outside preindustrial bounds
Biogeosciences (3.753)
A. J. Sutton, C. L. Sabine, R. A. Feely, W.-J. Cai, **M. F. Cronin, M. J. McPhaden,** J. M. Morell, J. A. Newton, J.-H. Noh, S. R. Ólafsdóttir, J. E. Salisbury, U. Send, D. Vandemark, R. A. Weller **(OAR/PMEL)**

- Ocean carbonate observations from surface buoys reveal that marine life is currently exposed to conditions outside preindustrial bounds at 12 study locations around the world.
- Seasonal conditions in the California Current Ecosystem and Gulf of Maine also exceed thresholds that may impact shellfish larvae.
- High-resolution observations place long-term change in the context of large natural variability.

One of the major challenges to assessing the impact of ocean acidification on marine life is detecting and interpreting long-term change in the context of natural variability. This study addresses this need through a global synthesis of monthly

pH and aragonite saturation state (Ω_{arag}) climatologies for 12 open ocean, coastal, and coral reef locations using 3-hourly moored observations of surface seawater partial pressure of CO_2 and pH collected together since as early as 2010. Mooring observations suggest open ocean subtropical and subarctic sites experience present-day surface pH and Ω_{arag} conditions outside the bounds of preindustrial variability throughout most, if not all, of the year. In general, coastal mooring sites experience more natural variability and thus, more overlap with preindustrial conditions; however, present-day Ω_{arag} conditions surpass biologically relevant thresholds associated with ocean acidification impacts on Mytilus californianus ($\Omega_{arag} < 1.8$) and Crassostrea gigas ($\Omega_{arag} < 2.0$) larvae in the California Current Ecosystem (CCE) and Mya arenaria larvae in the Gulf of Maine ($\Omega_{arag} < 1.6$). At the most variable mooring locations in coastal systems of the CCE, subseasonal conditions approached $\Omega_{arag} = 1$. Global and regional models and data syntheses of ship-based observations tended to underestimate seasonal variability compared to mooring observations. Efforts such as this to characterize all patterns of pH and Ω_{arag} variability and change at key locations are fundamental to assessing present-day biological impacts of ocean acidification, further improving experimental design to interrogate organism response under real-world conditions, and improving predictive models and vulnerability assessments seeking to quantify the broader impacts of ocean acidification.
Publication date: 13 September 2016
Available online: http://www.biogeosciences.net/13/5065/2016/bg-13-5065-2016.html

Interhemispheric SST gradient trends in the Indian Ocean prior to and during the recent global warming hiatus
Journal of Climate (4.850)
L. Dong and M. J. McPhaden (OAR-PMEL)

- This study finds that during the recent alleged hiatus in global warming a distinct sea surface temperature gradient developed in the Indian Ocean at 10°S
- North of 10°S saw very little change in sea surface temperature around the year 2000 while temperatures south of 10°S rose at an accelerating rate.

Sea surface temperatures (SSTs) have been rising for decades in the Indian Ocean in response to greenhouse gas forcing. However, in this study we show that during the recent hiatus in global warming, a striking interhemispheric gradient in Indian Ocean SST trends developed around 2000, with relatively weak or little warming

to the north of 10°S and accelerated warming to the south of 10°S. We present evidence from a wide variety of data sources that this interhemispheric gradient in SST trends is forced primarily by an increase of Indonesian Throughflow (ITF) transport from the Pacific into the Indian Ocean induced by stronger Pacific trade winds. This increased transport led to a depression of the thermocline that facilitated SST warming presumably through a reduction in the vertical turbulent transport of heat in the southern Indian Ocean. Surface wind changes in the Indian Ocean linked to the enhanced Walker circulation also may have contributed to thermocline depth variations and associated SST changes, with downwelling favorable wind stress curls between 10°S and 20°S and upwelling favorable wind stress curls between the equator and 10°S. In addition, the anomalous southwesterly wind stresses off the coast of Somalia favored intensified coastal upwelling and off-shore advection of upwelled water, which would have led to reduced warming of the northern Indian Ocean. Though highly uncertain, lateral heat advection associated with the ITF and surface heat fluxes may also have played a role in forming the interhemispheric SST gradient change.
Publication date: 14 September 2016
Available online: http://dx.doi.org/10.1175/JCLI-D-16-0130.1

Ecological and economic consequences of ignoring jellyfish: A plea for increased monitoring of ecosystems
Fisheries (1.80)
R. D. Brodeur (NMFS/NWFSC), J. S. Link (NMFS/OAA), B. E. Smith (NMFS/NEFSC), M. Ford (NMFS/OST), D. Kobayashi (NMFS/PIFSC), T. T. Jones (NMFS/PIFSC)

- Having growing commercial interest, and major ecological, social, and economic impacts, gelatinous zooplankton are not typically monitored on a regular basis by fisheries scientists.
- Gelatinous zooplankton also play a positive role and are a natural part of most marine systems (e.g. provide fish habitat; enhance nutrient cycling; and provision food to many organisms throughout the food web).
- The authors recommend including gelatinous zooplankton in ecosystem monitoring portfolios given their variable roles and potential impacts. The risks of continuing to ignore gelatinous zooplankton are too high.

Gelatinous zooplankton can dominate the dynamics of marine ecosystems, have major ecological, social and economic impacts, are often indicative of broader ecosystem perturbations, and are increasingly being harvested by humans. Yet

fisheries scientists typically do not monitor these taxa on a regular basis, despite the existence of clear rationales and even mandated authorizations to do so. Notably, the costs of monitoring jellyfish during regular fisheries research cruises would be a small increase over the cost of running a large fishery survey and a small fraction of the costs caused by impacts from these taxa. As ecosystems experience increasing pressures from climate change and fisheries, we recommend considering routine monitoring before there is some future jellyfish-associated crisis.
Acceptance date: August 30, 2016
Expected publication date: Fall 2016

CROSS LINE OFFICE ARTICLES

No evidence of increased demersal fish abundance 6 years after marine protected area creation along the southeast United States Atlantic coast
Bulletin of Marine Science (1.503)
N. M. Bacheler (NMFS/SEFSC), C. S. Schobernd (NMFS/SEFSC), S. L. Harter (NMFS/SEFSC), A. W. David (NMFS/SEFSC), G. R. Sedberry (NOS/ONMS) and G. T. Kellison (NMFS/SEFSC)

- For a subset of the deepwater Marine Protected Areas (MPAs) established in 2009 by the South Atlantic Fishery Management Council (with the subset limited to those MPAs for which sufficient data were available for analysis), there was no indication of an MPA effect on the number of fish species, density of fished species, or density of vermilion snapper *R. aurorubens*.
- The lack of detection of an MPA effect could have been due to a true lack of effect, low statistical power, not enough data post-MPA creation, low compliance rates, suboptimal MPA shape and size, or some combination thereof.
- Given their current relatively low abundances, the sampling effort required to effectively assess potential MPA effects for most grouper species is well beyond current or historical levels of sampling.

Marine protected areas (MPAs) have been used widely as a conservation and fisheries management tool to protect fish and habitats. We used a time series (2001–2014) of underwater videos from submersibles and remotely operated vehicles to determine whether a series of MPAs established in early 2009 along the southeast United States Atlantic coast ("SEUS") has increased the number of fish

species, density of fished species, or the density of vermilion snapper, *Rhomboplites aurorubens* (Cuvier, 1829) compared to adjacent, non-reserve areas. We used univariate and multivariate approaches at two spatial scales (region-wide and MPA-specific) to test for a change in the number or density of fish species inside compared to outside MPAs. Overall, 185 fish taxa were observed from 1,021 video transects across all years of the study. We did not observe a higher number of species, density of fished species, or density of *R. aurorubens* inside compared to outside MPAs, either after region-wide standardization using generalized additive models or for nominal analyses focusing on two (Edisto or North Florida) MPAs. Using non-metric multidimensional scaling and analysis of similarity, we did not observe any change in community structure occurring inside the MPAs that was not simultaneously occurring outside the MPAs, both at the region-wide or MPA-level scale. We did not detect unique changes to the fish community inside MPAs after their creation, which could be due to low statistical power, not enough data post-MPA creation, low compliance rates, or suboptimal MPA shape and size, or some combination thereof. Given their current relatively low abundances, the sampling effort required to effectively assess potential MPA effects for most grouper species is well beyond current or historical levels of sampling.
Acceptance date: September 6, 2016

ADDITIONAL ARTICLES

NMFS Publications

Sea turtle bycatch in the large-mesh gillnet flounder fishery in Carteret County, North Carolina, USA, June-November 2009
Journal of the North Carolina Academy of Science (n/a)
B. L. Byrd, L. R. Goshe, T. Kolkmeyer, A. A. Hohn (NMFS/SEFSC)

- Observed sea turtle bycatch in in the first month (June) of the study was high enough that it needed to be addressed quickly. The data were transmitted in real-time and prompted conversations about the needs and strategy to reduce bycatch. Bycatch mitigation measures were implemented during the study period.

- The study revealed that North Carolina's Endangered Species Act Incidental Take Permit (ITP) for estuarine gillnet fisheries did not cover the necessary spatio-temporal scope of sea turtle bycatch.
- Based on the results of this study, North Carolina applied for and was granted the current ITP to mitigate sea turtle bycatch in state-wide estuarine gillnet fisheries through a series of requirements on gillnet gear construction and use, and a state-wide observer program to estimate sea turtle bycatch.

Sea turtle bycatch has been documented in the large-mesh gillnet fishery that targets flounder in estuarine waters of North Carolina (NC). However, only portions of the fishery operated under Endangered Species Act Incidental Take Permits and had regular observer coverage to determine the occurrence and extent of sea turtle bycatch. From June through November 2009, an Alternative Platform Observer Program (APOP) was initiated in southeastern Carteret County, NC, to document turtle entanglements. Observers covered 1.6% of the total number of large-mesh gillnet trips reported (1.1% of landings) and documented turtle bycatch (n=22) on 36% of the observed trips (12 of 33). Most turtles were recovered alive (n=15), and all interactions occurred in June, July, and August. Bycaught sea turtle species included 12 greens (*Chelonia mydas*), 5 Kemp's ridleys (*Lepidochelys kempii*), and 5 loggerheads (*Caretta caretta*). Hauls with bycaught turtles in June had a significantly greater mean string length than those without bycatch (P=0.02), but despite the institution of regulations limiting string length, no difference was found in mean string length overall before (June) and after (July-November) regulations went into effect. Documented turtle bycatch in this area supports the need for observer coverage across the entire spatiotemporal scope of the fishery at levels necessary for robust bycatch estimates. Representative observer data across longer time series can inform managers where and when bycatch risks are greatest and help in developing mitigation measures that decrease bycatch risk while reducing negative economic impacts on the fishers.
Acceptance date: August 17, 2016

Design and monitoring of woody structures and their benefits to juvenile steelhead trout (Oncorhynchus mykiss) using a net rate of energy intake model
Canadian Special Publication of Fisheries and Aquatic Sciences (n/a)
C. E. Wall, N. Bouwes, J. M. Wheaton, S. Bennett, W. C. Saunders, P. A. McHugh, **C. E. Jordan (NMFS/NWFSC)**

- Establishes mechanistic basis for fish-habitat relationships

- Demonstrates how stream restoration actions can change stream habitat characteristics
- Demonstrates how stream restoration actions can directly benefit rearing salmonid fishes

Despite substantial effort and resources being invested in habitat rehabilitation for stream fishes, mechanistic approaches to designing and evaluating how habitat actions influence the fish populations they are intended to benefit remain rare. We used a Net Rate of Energy Intake (NREI) model to examine expected and observed changes in energetic habitat quality and capacity from woody debris additions in a 40-m-long study reach being treated as part of a restoration experiment in Asotin Creek, WA. We simulated depths, velocities, and NREI values for pre-treatment, expected, and post-treatment habitat conditions, and we compared pre-treatment vs. expected and pre-treatment vs. post-treatment simulation results. The pre-treatment vs. expected topography simulations suggested treatment would increase energetically favorable reach area, mean NREI in the study area, and reach capacity. Pre-treatment vs. post-treatment comparisons yielded similar predictions, though to smaller magnitudes, likely due to the short time span and single high flow event between pre- and post-treatment data collection. We feel the NREI modeling approach is an important tool for improving the efficacy of habitat rehabilitation actions for stream fishes.
Acceptance date: August 25, 2016
Expected publication date: Fall 2016

Improving the forecast for biodiversity under climate change
Science (31.48)
M. C. Urban, G. Bocedi, A. P. Hendry, J.-B. Mihoub, G. Pe'er, A. Singer, J. R. Bridle, **L. G. Crozier**, L. De Meester, W. Godsoe, A. Gonzalez, J. J. Hellmann, R. D. Holt, A. Huth, K. Johst, C. B. Krug, P. W. Leadley, S. C. F. Palmer, J. H. Pantel, A. Schmitz, P. A. Zollner, J. M. J. Travis **(NMFS/NWFSC)**

- The authors outline a global effort needed to collect the data necessary to better understand, anticipate, and reduce the damaging effects of climate change on biodiversity.

New biological models are incorporating the realistic processes underlying biological responses to climate change and other human-caused disturbances. However, these more realistic models require detailed information, which is lacking for most species on Earth. Current monitoring efforts mainly document changes in biodiversity, rather than collect the mechanistic data needed to predict

future changes. Here, we describe and prioritize the biological information needed to inform more realistic projections of species responses to climate change. We also highlight how trait-based approaches and adaptive modeling can leverage sparse data to make broader predictions. We outline a global effort to collect the data necessary to better understand, anticipate, and reduce the damaging effects of climate change on biodiversity.
Publication date: 9 September 2016
Available online: http://science.sciencemag.org/content/353/6304/aad8466

Age, growth and natural mortality of schoolmaster Lutjanus apodus from the southeastern United States
PeerJ (2.1)
J. C. Potts, M. L. Burton, A. R. Myers (NMFS/SEFSC)

- First published age and growth study of schoolmaster in the Southeast U.S.
- Schoolmaster are managed by the SAFMC as part of the Snapper Grouper Complex, so the data can be used for ecosystem assessments or in "data-poor" species stock assessments.
- This study adds to understanding of the genus *Lutjanus*, and adds validation to longevity of the species in that group

Ages of schoolmaster (n = 136) from the southeastern Florida coast from 1981-2015 were determined using sectioned sagittal otoliths. Opaque zones were annular, forming March-July (peaking in May - June). Schoolmaster ranged in age from 1-42 years; the largest fish measured 505 mm total length (TL) and was 19 years old. The oldest fish measured 440 mm TL. Estimated body size relationships for schoolmaster were: W = 9.26 x 10-6 TL3.11 (n = 256, r2 = 0.95); W = 2.13 x 10-5 FL2.99 (n = 161, r2 = 0.95); TL = 1.03 FL + 10.36 (n = 143, r2 = 0.99); and FL = 0.96 TL – 8.41 (n = 143, r2 = 0.99), where W = whole weight in g, FL = fork length in mm, and TL in mm. The fitted von Bertalanffy growth equation was: Lt = 482 (1 - e-0.12 (t +2.79)) (n = 136). Based on published life history relationships, a point estimate of natural mortality for schoolmaster was M = 0.10, while age-specific estimates of M ranged from 1.57 – 0.18 for ages 1 - 42.
Acceptance date: September 8, 2016
Expected publication date: Fall 2016

Fine-scale monitoring of routine deep dives by gravid leatherback turtles during the internesting interval indicate a capital breeding strategy
Frontiers in Marine Science – Marine Megafauna Section (n/a)
J. Okuyama, J. A. Seminoff , P. H. Dutton, S. R. Benson (NMFS/SWFSC)

- First synthesis of western Pacific leatherback diving behavior during the internesting period
- Gravid leatherback turtles employ energy-saving strategies during the internesting interval in most regions; however, the specific characteristics of their diving behavior vary among sites because of bathymetric constraints and local oceanographic features.

The dive behavior of gravid leatherback turtles (*Dermochelys coriacea*) was studied during the internesting interval in two western Pacific nesting regions: Papua Barat, Indonesia, and the Solomon Islands in 2006, 2007 and 2010. We used three types of dive data: time-at-depth data (Papua Barat: N = 4; Solomon Islands: N = 6), intermittent dive data (Papua Barat: N = 6) obtained from ARGOS satellite transmitters, and continuous dive data obtained from recovered semi-archival tags (Papua Barat: N = 1, Solomon Islands: N = 1). All dive data demonstrated that the leatherback turtles routinely dove to deep waters (around 150 m) throughout the internesting interval. The continuous dive data showed that turtles spent 37.3% of their time in routine deep dives and that they stayed in cold waters below the thermocline. Fine-scale monitoring (1-s interval, 0.5 m of resolution) suggested that these routine deep dives were not accompanied with any wiggles (up-and-down undulations in the depth profile) or flat-bottom phases, and they reached deep waters by gliding, which suggests that these dives may have served to conserve energy and/or to thermoregulate. Comparison with the dive behavior in other regions (Costa Rica, French Guiana, Grenada, Malaysia, and St. Croix) suggests that gravid leatherback turtles in all regions except French Guiana assume an energy-saving strategy during the internesting interval that involves gliding to or resting on the sea floor in colder water. The behavioral tactics (dive patterns) they use, however, differ because of bathymetric constraints.
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Available online: http://dx.doi.org/10.3389/fmars.2016.00166

Locally adaptive nonparametric smoothing with Markov random fields and shrinkage priors
Bayesian Analysis (0.53)
J. R. Faulkner (NMFS/NWFSC), V. N. Minin

- New statistical method for nonparametric smoothing will aid in model fitting and model development for ecological models, including mark-recapture models.

We present a locally-adaptive nonparametric curve fitting method that we call Bayesian trend filtering. The method operates within a fully Bayesian framework and uses shrinkage priors to induce sparsity in order-*k* differences in the latent trend function, providing a combination of local adaptation and global control. Using a scale mixture of normals representation of shrinkage priors, we make explicit connections between our Bayesian trend filtering and *k*th order Gaussian Markov random field smoothing. We use Hamiltonian Monte Carlo to approximate the posterior distribution of model parameters because this method provides superior performance in the presence of the high dimensionality and strong parameter correlations exhibited by our models. We compare the performance of three prior formulations using simulated data and find the horseshoe prior provides the best compromise between bias and precision. We apply Bayesian trend filtering to two benchmark data examples frequently used to test nonparametric methods. We find that this method is flexible enough to accommodate a variety of data generating models and offers the adaptive properties and computational efficiency to make it a useful addition to the Bayesian nonparametric toolbox.
Acceptance date: February 8, 2016
Expected publication date: January 2017

Case diagnosis and characterization of suspected paralytic shellfish poisoning in Alaska
Harmful Algae (3.54)
J. L. Sporty, J. Jacob, K. Porter, K. Sullivan, M. Forester, R. Wang, **V. L. Trainer (NMFS/NWFSC**), S. Morton, G. Eckert, E. McGahee, J. Thomas, R. C. Johnson

- The paper describes a new method for diagnosing paralytic shellfish poisoning in humans by analyzing saxitoxins in urine.
- This work contributes to the protection of human health from shellfish toxins

Paralytic shellfish poisoning (PSP) in humans results from the unintentional consumption of shellfish that have bio-accumulated small molecule toxins from

phytoplankton in harmful algal blooms. PSP typically occurs from the consumption of recreationally-harvested shellfish from unmonitored beaches. Clinical manifestations present rapidly and include nausea, paresthesia, and weakness. In severe cases, PSP can result in death from respiratory failure. The diagnosis of PSP is presumptive based on the recent ingestion of shellfish and the presence of manifestations consistent with PSP, and it is confirmed with the detection of a paralytic shellfish toxin in a clinical specimen or food sample. Using a new laboratory urinary test we evaluated eleven patients for saxitoxin (STX)-induced PSP from June 2010 to November 2011 in Alaska. Nine of these cases had presumptive PSP based on recent consumption of shellfish and presentation of symptoms consistent with PSP including nausea, paresthesia, and lightheadedness or dizziness. Four cases were confirmed to have STX-PSP by urinalysis (24 to 364 ng STX/g creatinine). Three cases had clinical manifestations of PSP that improved though no STX was detected in their urine. These cases had no dysphagia or dysarthria, which were reported in the cases with confirmed STX-PSP. Another four cases were confirmed not to have STX-PSP based on non-detected STX in the urine and either the lack of clinical findings or determination of another cause of the outcome.
Publication date: August 30, 2016
Available online:
http://www.sciencedirect.com/science/article/pii/S1568988316300646

Joint dynamic species distribution models: a tool for community ordination and spatiotemporal monitoring
Global Ecology and Biogeography (6.76)
J. T. Thorson (NMFS/NWFSC), J. N. Ianelli (NMFS/AFSC), E. Larsen, **M.D. Scheuerell (NMFS/NWFSC**), C. Szuwalski, E. Zipkin

- This paper introduces a new method to simultaneously estimate abundance trends and distribution shifts for all species within a community, showing as example 10 demersal species in the Eastern Bering Sea and 63 butterflies in Ohio.
- The method shows that variation in density over time is more correlated for related species (species in the same genus) than otherwise unrelated species.
- The tool can be used for rapid community monitoring or to estimate species groupings within a community, or use when prioritizing management.

Spatial analysis of the distribution and density of species is of continued interest within theoretical and applied ecology. Species distribution models (SDM) are

increasingly used to analyze count, presence/absence, and presence-only data sets. There is a growing literature regarding dynamic SDM (which incorporate temporal variation in species distribution), joint SDM (which simultaneously analyze the correlated distribution of multiple species), and geostatistical models (which account for similarity between nearby sites caused by unobserved covariates). However, no previous study has combined all three attributes within a single framework. We therefore develop spatial dynamic factor analysis for use as a "joint, dynamic SDM" (JDSDM), which uses Gaussian random fields to account for spatial similarity when estimating one or more "factors." Each factor evolves over time following a density-dependent (Gompertz) process, and the log-density of each species is approximated as a linear combination of different factors. We demonstrate JDSDM using two multispecies case studies (an annual survey of bottom-associated species in the Bering Sea, and a seasonal survey of butterfly density in the continental USA) and show that that JDSDM can be used for species ordination, i.e., as a model-based estimator of which species have similar spatiotemporal dynamics. We also demonstrate how JDSDM can rapidly identify dominant patterns in community dynamics, including the partitioning of the Bering Sea into inner, middle, and outer domains, and the "flight curves" typical of early or late-emerging butterflies. We conclude by suggesting future research that could incorporate phylogenetic relatedness or functional similarity, and propose that our approach could be used to monitor community dynamics at large spatial and temporal scales.
Publication date: May 29, 2016
Available online:
http://onlinelibrary.wiley.com/doi/10.1111/geb.12464/abstract

parallelnewhybrid: an R package for the parallelization of hybrid detection using NEWHYBRIDS
Molecular Ecology Resources (5.29)
B. Wringe, R. Stanley, N. Jeffery; **E. C. Anderson (NMFS/SWFSC)**, I. Bradbury

- NEWHYBRIDS analyses is able to assign individuals to specific hybrid classes by making use of patterns of gene inheritance within each locus.
- Parallelnewhybrid is designed to decrease user burden when undertaking multiple NEWHYBRIDS analyses by leveraging parallel computational capabilities
- This tool is being applied to infer gene flow from farm-escaped Atlantic salmon in eastern Canada into wild populations.

Hybridization among populations and species is a central theme in many areas of biology, and the study of hybridization has direct applicability to testing hypotheses about evolution, speciation, and genetic recombination, as well as having conservation, legal and regulatory implications. Yet, despite being a topic of considerable interest, the identification of hybrid individuals, and quantification of the (un)certainty surrounding the identifications remains difficult. Unlike other programs that exist to identify hybrids based on genotypic information, NEWHYBRIDS is able to assign individuals to specific hybrid classes (e.g. F1, F2) because it makes use of patterns of gene inheritance within each locus, rather than just the proportions of gene inheritance within each individual. For each comparison and set of markers, multiple independent runs of each dataset should be used to develop an estimate of the hybrid class assignment accuracy. The necessity of analyzing multiple simulated datasets constructed from large genome-wide datasets presents significant computational challenges. To address these challenges we present parallelnewhybrid, an R package designed to decrease user burden when undertaking multiple NEWHYBRIDS analyses. parallelnewhybrid does so by taking advantage of the parallel computational capabilities inherent in modern computers to efficiently and automatically execute separate NEWHYBRIDS runs in parallel. We show that parallelization of analyses using this package affords users several-fold reductions in time over a traditional serial analysis. parallelnewhybrid consists of an example dataset, a README and three operating system-specific functions to execute parallel NEWHYBRIDS analyses on each of a computer's c cores. parallelnewhybrid is freely available on the long-term software hosting site GitHub (www.github.com/bwringe/parallelnewhybrid).
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Available online: http://onlinelibrary.wiley.com/doi/10.1111/1755-0998.12597/full

Can autocorrelated recruitment be estimated using integrated assessment models, and how does it affect population forecasts?
Fisheries Research (2.70)
K. F. Johnson, E. Councill, **J. T. Thorson**, E. Brooks, **R. D. Methot,** A. E. Punt **(NMFS/NWFSC)**

- This paper shows that we can improve our probabilistic forecasts of population rebuilding for fishes by acknowledging that years of good or poor recruitment (production of juvenile fishes) come in streaks.
- The results show that if recruitment is "autocorrelated" like this, then our forecasts are more uncertain than we typically assume. However, we also

show how to improve our forecast performance by estimating recruitment autocorrelation.

The addition of juveniles to marine populations (termed "recruitment") is highly variable due to variability in survival for larvae and early juvenile stages. Recruitment estimates are often large or small for several years in a row (termed "autocorrelated" recruitment). Recruitment may be autocorrelated due to numerous factors, including regime shifts and periodicity in environmental drivers affecting juvenile survival rates. The ability of stock assessments to accurately estimate the magnitude of recruitment autocorrelation, and its effect on the quality of forecasts of spawning biomass, has not generally been analyzed. We used a simulation experiment to evaluate how well Stock Synthesis (an "integrated" age-structured stock assessment modeling framework used extensively in the assessment of fish stocks) estimates autocorrelation in the presence of a range of levels of autocorrelation in recruitment deviations. The precision and accuracy of estimated autocorrelation, and the ability of the stock assessment framework to forecast the true dynamics of the system, were compared for scenarios where the autocorrelation parameter within the assessment was fixed at zero, fixed at its true value, internally estimated, or input as a fixed value determined using an external estimation procedure. Estimates of autocorrelation produced by Stock Synthesis were biased toward extreme values (i.e., towards 1.0 when true autocorrelation was positive and -1.0 when true autocorrelation was negative). Less biased estimates of autocorrelation were obtained by externally estimating it from the recruitment deviations estimated within Stock Synthesis. Ignoring autocorrelation when true recruitment is autocorrelated results in poor forecast interval coverage (i.e., a large proportion of simulation replicates where true biomass is outside the predictive interval for the forecast). However, the "external estimate" of autocorrelation generally improves forecast interval coverage. Collectively, our results suggest that autocorrelation estimates have good statistical performance when calculated from the estimated recruitment deviations. However, estimates are likely to be imprecise whenever there are relatively few years of data to estimate recruitment (i.e., less than 40 years of recruitment estimates).

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Spatial distribution of reef fish species along the southeast US Atlantic coast inferred from underwater video survey data
Plos One (3.54)
N. Bacheler, Z. Schobernd, D. Berrane, C. Schobernd, W. Mitchell, B. Teer, D. Glasgow **(NMFS/SEFSC-Beaufort**)

- This study used three years of underwater video survey data to understand the distribution of reef fish in the southeast United States
- The results reinforce the utility of underwater video as fishery-independent data that can help improve the management of reef fish.

Marine fish abundance and distribution often varies across spatial scales for a variety of reasons, and this variability has significant ecological and management consequences. We quantified the distribution of reef-associated fish species along the southeast United States Atlantic coast using underwater video survey samples (N = 4,855 in 2011–2014) to elucidate variability within species across space, depths, and habitats, as well as describe broad-scale patterns in species richness. Thirty-two species were seen at least 10 times on video, and the most commonly observed species were red porgy (*Pagrus pagrus*; 41.4% of videos), gray triggerfish (*Balistes capriscus*; 31.0%), black sea bass (*Centropristis striata*; 29.1%), vermilion snapper (*Rhomboplites aurorubens*; 27.7%), and red snapper (*Lutjanus campechanus*; 22.6%). Using generalized additive models, we found that most species were non-randomly distributed across space, depths, and habitats. Most rare species were observed along the continental shelf break, except for goliath grouper (*Epinephelus itajara*), which was found on the continental shelf in Florida and Georgia. We also observed higher numbers of species in shelf-break habitats from southern North Carolina to Georgia, and fewer in shallower water and at the northern and southern ends of the southeast United States Atlantic coast. Our study provides the first broad-scale description of the spatial distribution of reef fish in the region to be based on fishery-independent data, reinforces the utility of underwater video to survey reef fish, and can help improve the management of reef fish in the SEUS, for example, by improving indices of abundance.
Published: September 21, 2016
Available online:
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0162653

Prioritising research within animal behaviour to increase conservation efficacy
Trends in Ecology and Evolution (TREE) (16.735)
A. L. Greggor, O. Berger-Tal, D. T. Blumstein, L. Angeloni, C. Bessa-Gomes, B. F. Blackwell, C. Cassady St Clair, K. Crooks, S. de Silva, E. Fernández-Juricic, S. Z. Goldenberg, **S. L. Mesnick (NMFS/SWFSC)**, M. Owen, C. J. Price, D. Saltz, C. J. Schell, A. V. Suarez, R. R. Swaisgood, C. S. Winchell, W. J. Sutherland

- A team of wildlife managers and animal behaviour researchers conducted a research prioritization exercise, identifying 50 key questions that have the greatest potential to resolve critical conservation and management problems.
- These questions are intended to guide collaborative species conservation efforts between academically focused researches and wildlife managers

Poor communication between academically focused researchers and application-focused wildlife managers limits conservation progress and innovation. As a result, the input from overlapping fields, such as animal behaviour, is underused in conservation management despite its utility as a conservation tool and countless papers advocating its use. Communication and collaboration across these two disciplines are unlikely to improve without clearly identified management needs and demonstrable impacts of behavioural-based conservation management. To support this process, a team of wildlife managers and animal behaviour researchers conducted a research prioritisation exercise, identifying 50 key questions that have the greatest potential to resolve critical conservation and management problems. The resulting agenda highlights the diversity and extent of advances that both fields could achieve through collaboration.
Acceptance date: **7** September 2016

Age, growth and natural mortality of cubera snapper Lutjanus cyanopterus from the southeastern United States
PeerJ (2.1)
M. L. Burton (NMFS/SEFSC), J. C. Potts (NMFS/SEFSC), D. R. Carr

- This study presents the first published findings of life history parameters for cubera snapper from the Atlantic waters off the southeastern United States.
- The species is a top predator in the reef ecosystem, attaining lengths of over a meter and ages over 50 years.

Ages of cnot (era snapper (*Lutjanus cyanopterus* Cuvier, 1828) (*n* = 106) from the southeastern United States coast from 2001 – 2015 were determined using sectioned sagittal otoliths. We assumed that opaque zones were annular, forming April – August (peaking in May – June). Cubera snapper ranged from 4 – 55 yrs,

and the largest fish measured 1382 mm FL (fork length). Body size relationships for cubera snapper were: TL = 1.02 FL + 12.76 (n = 28, r^2 = 0.99), FL = 0.97 TL – 9.65 (n= 28, r^2 = 0.99), and W = 4.9 x 10^{-9} $TL^{3.16}$, where W is total weight (kilograms, kg) and TL is total length (mm). The von Bertalanffy growth equation for cubera snapper was $L_t = 1465\ (1 - e^{-0.05(t\ +3.80)})$ (n = 106). Point estimate of natural mortality was M = 0.08, while age-specific estimates of M ranged from 0.45 – 0.05 for ages 1– 55. This study presents the first published findings of life history parameters for cubera snapper from the Atlantic waters off the southeastern United States.
Published: 20 September 2016

Hierarchical analysis of taxonomic variation in intraspecific competition across fish species
American Naturalist (4.725)
A. Foss-Grant, E. Zipkin, **J. T. Thorson (NMFS/NWFSC**), O. Jensen, W. Fagan

- Estimates the shape of the stock-recruit relationship (which is central to fishing mortality and spawning biomass targets for fisheries managers in many regions) for several common groups of fishes.
- With regards to rockfishes (important on the US West Coast) the analysis shows weaker compensation than is commonly assumed in assessment models.

The nature and intensity of intraspecific competition can vary greatly among taxa, yet similarities in these interactions can lead to shared population dynamics among related organisms. Variation along the spectrum of intraspecific competition, with contest and scramble competition as endpoints, leads to vastly different responses to population density. Here we investigated the diversity of intraspecific competition within fish phylogenies, predicting that functional forms of density-dependent reproduction would be conserved in related taxa. Using a hierarchical model that links stock-recruitment parameters among populations, species, and orders, we found that density-dependence, and therefore the type of intraspecific competition, is tightly clustered within taxonomic groupings, as species within an order share similar degrees of compensation. Specifically, species within the orders Salmoniformes and Pleuronectiformes exhibited density-dependence indicative of scramble competition (overcompensation) while the orders Clupeiformes, Gadiformes, Perciformes, and Scorpaeniformes exhibited dynamics consistent with contest competition (compensation). Maximum potential recruitment also varied among orders, but with less clustering across species. We also tested whether

stock-recruitment parameters correlated with maximum body length among species, but found no strong relationship. Our results suggest that much of the variation in density-dependent reproduction among fish species may be predicted phylogenetically due to evolved life history traits and reproductive behaviors.
Published: 1 July 2016
Available online: http://onlinelibrary.wiley.com/doi/10.1890/15-0733.1/full

Saving the Spandrels? Adaptive genomic variation in conservation and fisheries management
Journal of Fish Biology (1.658)
D. Pearse (NMFS/SWFSC)

- Reviews recent advances in the elucidation of genes underlying adaptive phenotypes in nature and how they may, or may not, inform conservation and management of fishes.

As highlighted by many of the papers in this issue, research on the genomic basis of adaptive phenotypic variation in natural populations has made spectacular progress in the past few years, largely due to the advances in sequencing technology and analysis. Without question, the resulting genomic data will improve our understanding of regions of the genome under selection and extend our knowledge of the genetic basis of adaptive evolution. What is far less clear, but has been the focus of active discussion, is how such information can or should transfer into conservation practice to complement more typical conservation applications of genetic data. Before such applications can be realized, the evolutionary importance of specific targets of selection relative to the genome-wide diversity of the species as a whole must be evaluated. Here I discuss the key issues for the incorporation of adaptive genomic variation in conservation and management, using published examples of adaptive genomic variation associated with specific phenotypes in salmonids and other taxa to highlight practical considerations for incorporating such information into conservation programs. I describe scenarios in which adaptive genomic data could be used in conservation or restoration, constraints on its utility, and the importance of validating inferences drawn from new genomic data before applying them in conservation practice. Finally, I argue that an excessive focus on preserving the adaptive variation we can measure, while ignoring the vast unknown majority that we cannot, is a modern twist on the adaptationist programme that Gould and Lewontin critiqued almost 40 years ago.
Accepted: 30 August 2016

Temporally varying natural mortality: sensitivity of a virtual population analysis and an exploration of alternatives
Fisheries Research (1.903)
S. D. Allen (NMFS/SWFSC), W. H. Satterthwaite (NMFS/SWFSC), D. G. Hankin, D. J. Cole, and **M. S. Mohr (NMFS/SWFSC)**

- This paper assesses the robustness of salmon cohort reconstructions central to fisheries management to assumptions about adult natural mortality.
- It identifies an alternative for direct estimation of adult natural mortality and situations where the new method is or is not likely to offer an improvement on the status quo.

Cohort reconstructions (CR) currently applied in Pacific salmon management estimate temporally variant exploitation, maturation, and juvenile natural mortality rates but require an assumed (typically invariant) adult natural mortality rate (dA), resulting in unknown biases in the remaining vital rates. We explored the sensitivity of CR results to misspecification of the mean and/or variability of dA, as well as the potential to estimate dA directly using models that assumed separable year and age/cohort effects on vital rates (Separable Cohort Reconstruction, SCR). For CR, given the commonly assumed dA = 0.2, the error (RMSE) in estimated vital rates is generally small (≤ 0.05) when annual values of dA are low to moderate (≤ 0.4). The greatest absolute errors are in maturation rates, with large relative error in the juvenile survival rate. The ability of CR estimates to track temporal trends in the juvenile natural mortality rate is adequate (Pearson's correlation coefficient > 0.75) except for high dA (≥ 0.6) and high variability (CV > 0.35). The alternative SCR models allowing estimation of time-varying dA by assuming additive effects in natural mortality, fishing mortality, and/or maturation rates did not outperform CR across all simulated scenarios, and are less accurate when additivity assumptions are violated. Nevertheless an SCR model assuming additive effects on fishing and natural (juvenile and adult) mortality rates led to nearly unbiased estimates of all quantities estimated using CR, along with borderline acceptable estimates of the mean dA under multiple sets of conditions conducive to CR. Adding an assumption of additive effects on the maturation rates allowed nearly unbiased estimates of the mean dA as well. The SCR models performed slightly better than CR when the vital rates covaried as assumed. These separable models could serve as a partial check on the validity of CR assumptions about the adult natural mortality rate, or even a preferred alternative if there is strong reason to believe the vital rates, including juvenile and

adult natural mortality rates, covary strongly across years or age classes as assumed.
Accepted: 3 September 2016

Marine shoreline management- a 35 year evaluation of outcomes to San Juan County, Washington, USA
Journal of Coastal Management (1.433)
A. H. Windrope, T. Quinn, **K. L. Fresh (NMFS/NWFSC**), A. MacLennan, J. K. Gaydos

- This article evaluates the effectiveness of the Shoreline Management Act in one county, San Juan County, in Washington, USA.
- Shoreline conditions in San Juan County were characterized over three time periods spanning pre and post SMA and engaged community members were surveyed to identify improvements in the effectiveness of shoreline protection.
- The authors found the effect of the Shoreline Management Act has been inconsistent at best.

In 1976, Washington became the first state to implement the federal Coastal Zone Management Act (CZMA) primarily through the 1971 WA Shoreline Management Act (SMA). However, there has been little effort in Washington to evaluate outcomes of shoreline protection programs post SMA. In 2006-2008, we characterized shoreline conditions in San Juan County over three time periods spanning pre and post SMA and engaged community members to improve effectiveness of shoreline protection. We found modest improvements in forest retention on marine shorelines between pre and post 1977, but few other improvements through time. While we could not measure shoreline construction rates, construction practices for shore armor and overwater structures (docks) have changed very little, despite the increased regulatory standards. The vast majority of shore armor constructed post SMA occurred without mandatory county or state permits likely due to: widespread perception that permits were unnecessary and that permit standards were arbitrary and inconsistently applied; poor understanding of shoreline ecology by community members; lack of county or state enforcement authority and shoreline monitoring programs; and poor permit tracking systems.
Acceptance date: July 31, 2016
Expected publication date: Fall 2016

Reef-scale trends in Florida Acropora *spp. abundance and the effects of population enhancement*
PeerJ (2.183)

- This study, using low-resolution mapping observations at hectare scales from 2005 to 2015, documents 40-70% declines in baseline colony densities for Acropora palmata and A. cervicornis across reefs in the upper Florida Keys.
- Sites with A.cervicornis population enhancement effort contrasted this trend with a mean 13x increase in colony density and showed a significant positive linear relationship between total enhancement effort (i.e. cumulative number of coral fragments outplanted) and change in colony density.
- This is the first study to document positive effects of Acropora population enhancement effort at a reef scale.

Since the listing of *Acropora palmata* and *A. cervicornis* under the U.S. Endangered Species Act in 2006, increasing investments have been made in propagation of listed corals (primarily *A. cervicornis*, *A. palmata* to a much lesser extent) in offshore coral nurseries and outplanting cultured fragments to reef habitats. This investment is superimposed over a spatiotemporal patchwork of ongoing disturbances (especially storms, thermal bleaching, and disease) as well as the potential for natural population recovery. In 2014 and 2015, we repeated broad scale (>50 ha), low precision *Acropora* spp. censuses (i.e., direct observation by snorkelers documented via handheld GPS) originally conducted in appropriate reef habitats during 2005-2007 to evaluate the trajectory of local populations and the effect of population enhancement. Over the decade-long study, *A. palmata* showed a cumulative proportional decline of 0.4 – 0.7x in colony density across all sites, despite very low levels of outplanting at some sites. *A. cervicornis* showed similar proportional declines at sites without outplanting. In contrast, sites that received *A. cervicornis* outplants showed a dramatic increase in density (over 13x). Indeed, change in *A. cervicornis* colony density was significantly positively correlated with cumulative numbers of outplants across sites. This study documents a substantive reef-scale benefit of *Acropora* spp. population enhancement in the Florida Keys, when performed at adequate levels, against a backdrop of ongoing population decline.
Acceptance date: September 4, 2016

A hypothesis of a redistribution of North Atlantic swordfish based on changing ocean conditions

Deep Sea Research II (2.85)

- Swordfish were found to change their Atlantic wide distribution in relation to changes in oceanographic conditions, specifically to sea surface temperature
- Accounting for this redistribution improved the stock assessment of swordfish
- Alternatively, the northern Atlantic swordfish stock may in fact be two separate stocks

Conflicting trends in indices of abundance starting in the mid-to late 1990s, in the form of fleet specific catch-per-unit-effort (CPUE), for north Atlantic swordfish suggest the possibility of a spatial shift in abundance to follow areas of preferred temperature. The observed changes in the direction of the CPUEs correspond with changes in trends in the summer Atlantic Multidecadal Oscillation (AMO), a long term mode of variability of north Atlantic sea surface temperature. To test the hypothesis of a relation between the CPUE and the AMO, the CPUEs were made spatially explicit by re-estimating using an "areas-as-fleets" approach. These new CPUEs were then used to create alternative stock histories. The residuals of the fit were then regressed against the summer AMO. Significant, and opposite, relations were found in the regressions between eastern and western Atlantic areas. When the AMO was in a warm phase, the CPUEs in the western (eastern) areas were higher (lower) than predicted by the assessment model fit. Given the observed temperature tolerance limits of swordfish, it is possible that either their preferred habitat, prey species, or both have shifted spatial distributions resulting in conflicting CPUE indices. Because the available CPUE time series only overlaps with one change in the sign of the AMO (~1995), it is not clear whether this is a directional or cyclical trend. Given the relatively localized nature of many of the fishing fleets, and the difficulty of separating fleet effects from changes in oceanography we feel that it is critical to create CPUE indices by combining data across similar fleets that fish in similar areas. This approach allowed us to evaluate area-specific catch rates which provided the power to detect basin-wide responses to changing oceanography, a critical step for providing robust management advice in a changing climate.

Acceptance date: August 12, 2016

Available online:

http://www.sciencedirect.com/science/article/pii/S0967064516302211

OAR Publications

A complex baleen whale call recorded in the Mariana Trench Marine National Monument
Journal of the Acoustical Society of America (1.503)
S. L. Nieukirk, S. Fregosi, D. K. Mellinger, H. Klinck (OAR PMEL/CIMRS)

- Recorded sounds in the Mariana Trench Marine National Monument area were not consistent with anthropogenic or geophysical sources. The sounds were likely biological in origin.
- Given the call characteristics and low-frequency components of this sound, it is likely produced by a baleen whale.
- This is supported by the presence of numerous species of baleen whale residing in this area. Characteristics of this sound most closely resemble sounds made by minke whales.

In fall 2014 and spring 2015, passive acoustic data were collected via autonomous gliders east of Guam in an area that included the Mariana Trench Marine National Monument. A short (2–4 s), complex sound was recorded that features a ~38 Hz moan with both harmonics and amplitude modulation, followed by broad-frequency metallic-sounding sweeps up to 7.5 kHz. This sound was recorded regularly during both fall and spring surveys. Aurally, the sound is quite unusual and most resembles the minke whale "Star Wars" call. It is likely this sound is biological and produced by a baleen whale.
Publication date: September 13, 2016
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http://scitation.aip.org/content/asa/journal/jasa/140/3/10.1121/1.4962377

Comparing chemistry and census-based estimates of net ecosystem calcification on a rim reef in Bermuda
Frontiers in Marine Science (n/a)
T. A. Courtney, A. J. Andersson, N. R. Bates, A. Collins, T. Cyronak, S. J. de Putron, B. D. Eyre, R. Garley, E. J. Hochberg, R. Johnson, **S. Musielewicz**, T. Noyes, C. L. Sabine, **A. J. Sutton**, J. Toncin, and A. Tribollet **(OAR/PMEL)**

- This paper explores the mechanisms behind reef net ecosystem calcification

Coral reef net ecosystem calcification (NEC) has decreased for many Caribbean reefs over recent decades primarily due to a combination of declining coral cover and changing benthic community composition. Chemistry-based approaches to calculate NEC utilize the drawdown of seawater total alkalinity (TA) combined

with residence time to calculate an instantaneous measurement of NEC. Census-based approaches combine annual growth rates with benthic cover and reef structural complexity to estimate NEC occurring over annual timescales. Here, NEC was calculated for Hog Reef in Bermuda using both chemistry and census-based NEC techniques to compare the mass-balance generated by the two methods and identify the dominant biocalcifiers at Hog Reef. Our findings indicate close agreement between the annual 2011 census-based NEC 2.35 ± 1.01 kg CaCO3•m-2•y-1 and the chemistry-based NEC 2.23 ± 1.02 kg CaCO3•m-2•y-1 at Hog Reef. An additional record of Hog Reef TA data calculated from an autonomous CO2 mooring measuring pCO2 and modeled pHtotal every 3 hours highlights the dynamic temporal variability in coral reef NEC. This ability for chemistry-based NEC techniques to capture higher frequency variability in coral reef NEC allows the mechanisms driving NEC variability to be explored and tested. Just four coral species, *Diploria labyrinthiformis*, *Pseudodiploria strigosa*, *Millepora alcicornis*, and *Orbicella franksi*, were identified by the census-based NEC as contributing to 94 ± 19% of the total calcium carbonate production at Hog Reef suggesting these species should be highlighted for conservation to preserve current calcium carbonate production rates at Hog Reef. As coral cover continues to decline globally, the agreement between these NEC estimates suggest that either method, but ideally both methods, may serve as a useful tool for coral reef managers and conservation scientists to monitor the maintenance of coral reef structure and ecosystem services.
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Summertime rainfall events in eastern Washington and Oregon
Weather and Forecasting (1.860)
A. M. Chiodi (OAR-PMEL/JISAO), N. A. Bond (OAR-PMEL/JISAO), N. K. Larkin, and J. Barbour

- northern portion of the domain of interest, and over the higher terrain, is associated with anomalous midtropospheric southwesterly flow
- a high percentage of the events in the southern and lower elevation portions of the domain is associated with southeasterly flow anomalies.
- forests of eastern Washington and Oregon receive a mix of southeasterly and southwesterly events. Results suggest that identifying flow types by (skillful) extended-range 500-hPa forecasts may provide a useful basis for predicting the associated aspects of the rainfall event distribution.

The temporal and spatial characteristics of summertime rainfall events in the Pacific Northwest are examined in relation to the prevailing regional 500-hPa geopotential height conditions, with focus on the forested slopes of eastern Washington and northeastern Oregon, where the absence/occurrence of events largely determines the start and end of the wildland fire season. The Daily U.S. Unified Precipitation dataset is used for specifying rainfall events (period 1949–2008). Events are defined as one or more consecutive days of rainfall exceeding 0.25 in. (0.65 mm), and occur on average two to three times per summer (July–September) in the focus region, east of the Cascade Mountain crest, with a minimum in frequency in late July. A relatively high percentage of the events in the northern portion of the domain of interest, and over the higher terrain, is associated with anomalous midtropospheric southwesterly flow; a high percentage of the events in the southern and lower elevation portions of the domain is associated with southeasterly flow anomalies. Southeasterly flow events are much more likely to be accompanied by lightning and a more localized rainfall distribution than southwesterly events. Southwesterly events mainly account for the late-July frequency minimum and produce more widespread/heavier precipitation on average. The forests of eastern Washington and Oregon receive a mix of southeasterly and southwesterly events. Results suggest that identifying flow types by (skillful) extended-range 500-hPa forecasts may provide a useful basis for predicting the associated aspects of the rainfall event distribution.
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A multi-decade record of high quality fCO_2 data in version 3 of the Surface Ocean CO_2 Atlas (SOCAT)
Earth System Science Data (8.268)
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- Version 3 of the Surface Ocean CO_2 Atlas (SOCAT) has 14.7 million CO_2 values for the years 1957 to 2014 covering the global oceans and coastal seas.
- Version 3 is an update to version 2 with a longer record and 44 % more CO_2 values.

The Surface Ocean CO_2 Atlas (SOCAT) is a synthesis of quality-controlled fCO_2 (fugacity of carbon dioxide) values for the global surface oceans and coastal seas with regular updates. Version 3 of SOCAT has 14.7 million fCO_2 values from 3646 data sets covering the years 1957 to 2014. This latest version has an additional 4.6 million fCO_2 values relative to version 2 and extends the record from 2011 to 2014. Version 3 also significantly increases the data availability for 2005 to 2013. SOCAT has an average of approximately 1.2 million surface water fCO_2 values per year for the years 2006 to 2012. Quality and documentation of the data has improved. A new feature is the data set quality control (QC) flag of E for data from alternative sensors and platforms. The accuracy of surface water fCO_2 has been defined for all data set QC flags. Automated range checking has been carried out for all data sets during their upload into SOCAT. The upgrade of the interactive Data Set Viewer (previously known as the Cruise Data Viewer) allows better interrogation of the SOCAT data collection and rapid creation of high-quality figures for scientific presentations. Automated data upload has been launched for version 4 and will enable more frequent SOCAT releases in the future. High-profile scientific applications of SOCAT include quantification of the ocean sink for atmospheric carbon dioxide and its long-term variation, detection of ocean acidification, as well as evaluation of coupled-climate and ocean-only biogeochemical models. Users of SOCAT data products are urged to acknowledge the contribution of data providers, as stated in the SOCAT Fair Data Use Statement. This ESSD (Earth System Science Data) "living data" publication

documents the methods and data sets used for the assembly of this new version of the SOCAT data collection and compares these with those used for earlier versions of the data collection (Pfeil et al., 2013; Sabine et al., 2013; Bakker et al., 2014). Individual data set files, included in the synthesis product, can be downloaded here: doi:10.1594/PANGAEA.849770. The gridded products are available here: doi:10.3334/CDIAC/OTG.SOCAT_V3_GRID.
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Evidence for gap flows in the Birch Creek Valley, Idaho
Journal of the Atmospheric Sciences (3.220)
Dennis Finn, Brad Reese, Bret Butler, Natalie Wagenbrenner, **Kirk Clawson, Jason Rich,** Eric Russell, Zhongming Gao, Heping Liu

- Wildfire seasons have grown in length and intensity and an improved understanding of mountain-valley flows will aid in the improvement of forecasts in fighting wildfires.
- Gap flows commonly developed downwind of a constriction in the Birch Creek Valley in thermally-dominated, non-synoptic conditions
- These results may also inform siting and estimates of wind power potential, as well as better understanding pollutant dispersion in mountain-valley terrain.

A field study was conducted of flows in the Birch Creek Valley in eastern Idaho. There is a distinct topographic constriction in the Birch Creek Valley that creates two sub-basins, an upper and lower valley. The data were classified into one of three groups based on synoptic influence (weak/absent, high wind speeds, and other evidence of synoptic influence). Gap flows commonly developed downwind of the constriction in association with the weak/absent group but also occurred in association with the two synoptic groups suggesting the potential for more diverse origins. In general, the frequency and strength of gap flows appeared to be linked to the development of the requisite thermal regime and minimization of any synoptically-driven southerly winds that would suppress outflows. Gap flows were characterized by high wind speeds with jet-like vertical profiles along the axis of the lower valley. For all three groups the morning transition in the upper valley and western sidewall usually proceeded slightly ahead of the lower valley, consistent with the principles of the topographic amplification factor. The persistence of southerly winds in the lower valley past evening transition inhibited the

development of gap flows, promoted strong nighttime inversions, and delayed the onset of morning transition relative to the upper valley. Nocturnal temperature inversions in the lower valley were largely eliminated with the onset of strong gap flows resulting in earlier morning transitions there. The form for a method of predicting gap flow wind speeds is proposed.
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Available online: http://journals.ametsoc.org/doi/abs/10.1175/JAS-D-16-0052.1?af=R&

NWS Publications

Skill assessment of techniques for real-time diagnosis and short-term prediction of tornado intensity using the WSR-88D
Journal of Operational Meteorology (n/a)
J. G. Gibbs (NWS/Warning Decision Training Division)

- This study builds off existing studies to sharpen thresholds for using the WSR-88D to diagnose when a EF-2 or stronger tornado is occurring in real time.
- The authors present new methods that show reasonable skill at determining when a EF-2 tornado may be about to occur, at 10 to 15 minutes lead time.

Recent advancements in the science of tornado detection have allowed the National Weather Service's (NWS) Warning Decision Training Division to incorporate real-time tornado intensity estimation into guidance available to NWS forecasters. This guidance focuses specifically on differentiating between strong/violent (EF-2+) and weak (EF-0–1) tornadoes. This study evaluates the skill of a portion of that guidance, specifically the quantification of the relationship between rotational velocity signatures and the height of tornado debris signatures with observed EF-scale tornado damage. The guidance is found to be sufficiently skillful at diagnosing tornado intensity. Perhaps most usefully, when attempting to differentiate between weak and strong/violent tornadoes in real-time, skill scores peak at the threshold of 20.57 m s^{-1} (40 kt) of rotational velocity when the velocity couplet is combined with a tornado debris signature. Skill sufficient for operational decision making is also evaluated and found in other permutations of rotational velocity, with and without a tornado debris signature, and the guidance regarding the height of the tornado debris signature. Beyond real-time diagnosis, several subjectively analyzed WSR-88D parameters show skill within the dataset at

differentiating between strong/violent and weak tornadoes with lead times of 2 to 3 volume scans.
Accepted: 31 August 2016

Comments on "Double impact: When both tornadoes and flash floods threaten the same place at the same time"
Weather and Forecasting (2.35)
M. J. Bunkers (NWS/UNR), C. A. Doswell

- Hodographs can be used to assess the possibility of slow-moving supercells that may result in collocated tornado and flash flood events.
- Forecasters in warning operations would benefit by looking at hodographs and plan-view displays of predicted supercell motion to help increase situation awareness of combined tornado/flash flood environments.

Nielsen et al. (2015) studied environments of concurrent, collocated tornado and flash flood (hereafter TORFF) events that occurred across the continental United States from 2008 to 2013. They found that TORFF events are difficult to distinguish from tornado events that do not produce flash flooding, although the TORFF environments tended to possess greater moisture and synoptic-scale forcing for ascent. [much deleted] ...our goals are to (i) discuss the importance of storm (and supercell) motion in potentially helping to anticipate TORFF events, 41 (ii) provide examples contrary to the notion that tornadic storms are necessarily fast moving, as well as discuss briefly the characteristics of slow-moving tornadic supercell environments, and (iii) clarify the relationship of CAPE with rainfall and precipitation efficiency.
Expected Publication: 1 January 2017

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NMFS PUBLICATIONS

The Quantification and Presentation of Risk
Book Chapter
Book: Management Science in Fisheries Ed. Edwards, C. T. and Dankel, D. J. Routledege 448 pp.
L.T. Kell, P. Levontin, C. Davies, M. Maunder, G. Pilling, and **R. Sharma (NMFS/SEFSC)**

- Across global Tuna RFMOs , the quantification and presentation of risk varies quite a lot
- However, for Management Strategy Evaluation the following are essential: Identifying objectives, selecting alternative realities that cover all possible aspects in the simulation model (the Operating Model (OM)) with uncertainty, conditioning the OM, developing candidate Management Procedures (MPs) and coding them as harvest control rules, simulating the OM forward with feedback control, and presenting as set of MP's that meet the management objectives
- The chapter discusses the pros and cons of each step of the process, how they differ across Tuna RFMOs, and provides some common diagnostics/tools for presenting the results so policy makers can adopt a MP for use

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NOS Publications

Mapping ecological priorities and human impacts to support land-sea management of Puerto Rico's Northeast Marine Ecological Corridor
NOAA Technical Memorandum
S. J. Pittman, C. F. G. Jeffrey, C. Menza, G. Kågesten**, A. Orthmeyer, D. Dorfman, D. Mateos-Molina, V. Ransibrahmanakul, A. R. Álvarez (NOS/NCCOS)**

- The map products support decision making in marine spatial planning for the northeast region of Puerto Rico.
- Marine priority areas and human threats to those areas were identified and mapped and used to identify ecological areas of concern.
- Priority areas were ranked and optimal design scenarios were calculated and mapped to support MPA design.

This report describes a spatial characterization conducted to support the development of an integrated management plan for Puerto Rico's Northeast Marine Ecological Corridor. The Northeast Marine Ecological Corridor is a large, land-sea reserve network, making it unique in the region for both its size and the integrated land-sea geographical scope. Here we map and model ecological priorities and threats to support managers with risk assessment and prioritization of

management actions. The best available data, including local expert knowledge of special ecological places and threats, were compiled to map key marine features, important habitat types and marine species of concern. Ecological priority areas were identified and ranked based on the number of ecologically important attributes across the region and analyzed relative to the distribution of threats and stressors to help managers identify and prioritize areas of concern. The methods and data used for spatial prioritization are described in this report and resultant maps showing ecological priorities and potential stressors are provided. The approach was implemented through a partnership between NOAA National Centers for Coastal Ocean Science and the Department of Natural and Environmental Resources of Puerto Rico DNER (Departamento de Recursos Naturales y Ambientales - DRNA) with funding provided by NOAA Coral Reef Conservation Program.
Acceptance date: June 2016